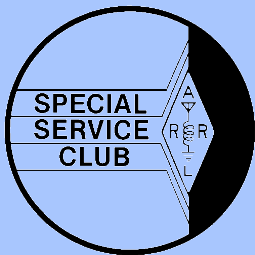




# The Raleigh Amateur Radio Society's **EXCITER**

## GET INVOLVED

- RARS General Membership meeting: **Second Tuesday** of the month.
- The RARS net meets every night except Saturday @ 8 p.m. on 146.640.
- The RARS Technical & Trader's net: Saturdays @ 8:00 PM on 146.64.
- RARS meets for a monthly dinner on the **First Tuesday** of each month.
- On the **fourth Tuesday** of every month, in-person meeting at Ridge Road Baptist Church where there will be project tables, demos, snacks, and socializing.



## PUBLIC SERVICE EVENTS

Interested in helping? Visit  
<https://www.rars.org/public-service.php>

frequently for our 2021 ham public service schedule.

## RARS General Meeting

**Main Topic:** Bridgecom DMR

Presentation by Josh Landewee,

Sales Representative

**Date:** April 12, 2022

**Time:** Meeting at 7:30 PM, informal gathering at 7PM on Zoom.

**Where:** Zoom

## RARS Net Monthly Summary

March 2022 RARS net reports

31 nightly 2m nets

455 checkins

986 minutes

KT4JR Julie Royster

## RARS Officers

### **PRESIDENT**

John Honeycutt  
N8ZU  
919.417.2477  
jfh49@bellsouth.net

### **VICE PRESIDENT**

Tom Lewis  
N4TL  
[N4TL2@yahoo.com](mailto:N4TL2@yahoo.com)

### **SECRETARY**

Mark Kilmer  
KM4JRH  
919.676.0110  
mark.kilmer@gmail.com

### **TREASURER**

Greg Seamster  
KE4PAX  
919.859.0029  
[KE4PAX@arrl.net](mailto:KE4PAX@arrl.net)



## The Raleigh Amateur Radio Society

The Raleigh Amateur Radio Society, Inc. (RARS) was founded in 1969 and continues to serve and support the amateur radio community in the greater Triangle area. In 1999, the society incorporated a new RARS and obtained 501(c)(3) non-profit tax status.

The objectives of the club are to promote worldwide friendship through amateur radio; to be of public service by providing radio communications in times of disaster, emergency, or civic needs; to educate members in radio technique, and to provide training classes to assist in obtaining amateur radio licenses.

Anyone interested in amateur radio is eligible to apply for membership. Regular dues for licensed amateurs are \$18 per year. (From July 1 through June 30.) Additional licensed immediate family members pay \$5 each per year. Dues for licensed full time students and licensed seniors 60 and over are \$12 per year. Unlicensed individuals may become associate members for \$9 per year. Applications for membership are available from the treasurer or on the RARS web site.

<https://www.rars.org>

---

## ***Exciter***

The Exciter is the official newsletter of the Raleigh Amateur Radio Society. It appears each month as a PDF on the RARS website at [www.rars.org](http://www.rars.org). Members receive email notification when the latest version is available. Please provide your email address to the Treasurer.

The Exciter welcomes articles, advertisements, and other contributions. To submit a piece to the newsletter, please contact the Editor. The Editor reserves the right to edit any and all pieces. The submission deadline for each month's Exciter is the Saturday that is ten days before the general meeting. All submissions must be final. Drafts are not accepted.

The views expressed in the Exciter are those of the individual authors and do not necessarily reflect the views of the Editor or RARS.

Tom Lewis, N4TL, editor ([editor@rars.org](mailto:editor@rars.org))

## Presidents Message, April 2022

April is a big month for RARS. Our biggest event of the year, *RARSfest*, is resuming after having been cancelled for two years. It promises to be a big event. Tickets and vendor tables are selling very well, and there will be quite a few dealer booths as well.

Again this year we host the ARRL Roanoke Division Convention.

There will be many Forums and Events, including the ARRL open Forum, “An Intro to DSTAR, Fusion, and DMR,” by Brian Young, SKYWARN basic spotter training, and “Introduction to Amateur Satellites.”

The project table, “Build a Wire J-Pole,” will be at the fest so you can build a portable VHF antenna. I volunteered for a shift at that table in 2019, and it was a lot of fun.

As usual, there will be license exams starting promptly at 9:00 AM. You can take exams without buying a ticket for the ham fest, but after you get your license or upgrade, you’ll want to stay to shop, learn, socialize, and learn.

All this and more will be at the Jim Graham Building at the North Carolina State Fairgrounds on Saturday, April 16. Pre-registration ticket sales are available at our web site until April 9, and you can save a buck by purchasing on line. Tickets at the door are \$10. You can check out all the details at the *RARSfest* web site, <https://www.rarsfest.org>. You can also go to <https://www.rars.org/> and click on the *RARSfest* button on the left, third from the top.

And did I mention that you can volunteer to help out at *RARSfest*? Most volunteer slots are only two hours, and many volunteer positions are still available. You can volunteer at the *RARSfest* web site under the “Volunteer” drop down menu.

Our monthly meetings will continue on Zoom for the time being. The reason the board has chosen to continue on-line meetings is that the format seems to work well for our business meetings and programs. Attendance has continued at levels similar to our past in-person meetings, and Zoom makes the meetings available to members outside of the Triangle or those who prefer not to drive to meetings. Our next meeting is April 12 at 7:30. The program will be “Bridgecom DMR Presentation” by Josh Landewee

BUT -- for those wishing to meet in person, there are **new monthly opportunities** to meet face-to-face with fellow hams. On the fourth Tuesday of every month, we are having an in-person meeting at Ridge Road Baptist Church where there will be project tables, demos, snacks, and socializing. I went to the first one in March, and had a great time both chatting and doing Radio for a couple of hours. The next one will be April 26 at 7:00 PM. Details on <https://www.rars.org/>

We also have a new Portable Operating Special Interest Group that will meet monthly at a local park or other outdoor area to learn about and operate portable rigs, antennas, go-kits, batteries and other portable needs. Check out <https://www.qrz.com/db/K4CBW> for updated information.

I hope to see you at *RARSfest* April 16.

John Honeycutt, N8ZU

---

<https://www.rars.org>

## March 8, 2022 RARS meeting

The meeting was held on Zoom. Many members connected from 7PM on. President John Honeycutt, N8ZU, ran the formal part of the meeting. See the meeting minutes on [page 24](#) for details. During the meeting John announced the following Awards

Nancy Torborg, KB2TNR – In appreciation for stepping up to be the 2022 Rarsfest Chairwoman.

Alan Pitegoff, AB4OZ – In appreciation for creating the AB4OZ Hamfest and the weekly TACO Thursday outing to help provide fellowship for RARS and hams throughout the ham community.

Tom Lewis, N4TL – In appreciation, as current RARS Exciter Editor, for continuing to provide a First Class RARS Newsletter.

Tadd Torborg, KA2DEW – In appreciation in leading his team, RARS and the ham community in building the TARP Network

Chuck deCourt, W3WZN – In appreciation of his ongoing leadership of the RARS Repeater Committee and as the ARRL NC State Government Liaison.

Curt Phillips, W4CP – In appreciation, as the 2021 RARS Field Day Chairman, for his leadership and great results of our event.

Marty Young, W4MY – In appreciation, as Chairman, of his Ten Years of Leadership of the NC QSO Party

Marc Sullivan, W4MPS – In appreciation for his good work as a long-standing member of the NCQSO Party Committee and Awards Manager.

Jeremy Lindsley, K2HJX – In appreciation as the RARS Public Service Director, for his leadership of RARS and area hams in public service.

Brantley West, K4CBW – In appreciation as RARS Youth Director in leading several NCS Students to use and enjoy Ham Radio.

Charlie Durst, NC4CD – In appreciation of his several years of RARS Repeater Committee support

Mark Gibson, N4MQU – In appreciation for leading the Five County Ham Radio Enthusiasts Group to encourage the growth of ham radio in and out of our region with Beginner Workshops and Cost Free Exams.

Curt Phillips, W4CP – In appreciation of having founded the Tarheel Shortwave Scanner Sig Thirty Years ago and is still going strong.

## March 8, 2022 RARS meeting, continued

After the formal part of the meeting. Tom, N4TL Introduced Nancy Torborg, KB2TNR. She spoke about the upcoming RARSfest.

# Hello!

## I am Nancy KB2TNR

I am chairman of the 2022 RARSFest™ because I believed that RARSFest™ *could* and should go on for 2022.

You can find me at [ntorborg@mac.com](mailto:ntorborg@mac.com)



**Raleigh Amateur Radio Society**

Worldwide Friendship • W4DW/W4RNC • Raleigh, NC • An ARRL Special Service Club  
146.64 • 145.13 (82.5) • 444.525 (82.5)



# 48th Annual RARSFest™ 2022

Nancy Torborg

## Volunteers Needed

Screen captures during the presentation



March 8, 2022 RARS meeting presentation

## The Raleigh Amateur Radio Society Hamfest™

- Setup- Friday, April 15th
- Show - Saturday, April 16th
- Location - The Jim Graham Building  
4825 Trinity Road  
Raleigh, NC 27607



The screenshot shows the top section of the RARSfest website. At the top is a blue navigation bar with white text links: HOME, Activities, Events, Travel, Registration, and Media. Below this is a red banner with white text: ► 2022 RARSfest COVID-19 Policy. The main heading in red text reads: **RARSfest - The Raleigh ARRL Hamfest and ARRL Roanoke Division Convention**. Below the heading, in red text, is: **8AM-3:00PM Saturday April 16, 2022**. On the left is a small globe icon with 'RARS' text, and on the right is a circular logo for the 'SPECIAL SERVICE CLUB'. Below the text are two side-by-side photographs of a crowded hamfest event with many people and tables.

HOME Activities Events Travel Registration Media

► 2022 RARSfest COVID-19 Policy

**RARSfest - The Raleigh ARRL Hamfest  
and ARRL Roanoke Division Convention**

**8AM-3:00PM Saturday April 16, 2022**

Welcome to the 48th Annual RARSfest

Screen captures during the presentation

You can volunteer to help at our website

[RARSfest - The NC Capital City Hamfest](https://www.rars.org)

## March 15 , 2022 RARS meeting

|                                                                                                               |                                                                                                                      |                                                                                                                    |
|---------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
|  TL Tom Lewis, N4TL          |  CW Charles WA4OSS                  |  Nancy Torborg KB2TNR           |
|  Mark-KM4JRH Raleigh (Host)  |  Chuck K4RGN Raleigh NC             |  NJ NC4JP, John, Raleigh        |
|  JH John Honeycutt - N8ZU    |  David Peterson KN8DAP              |  RK Richard K7RLH Apex          |
|  Tadd (KA2DEW) Torborg       |  DW dennis wz0q                     |  RN Richard, N1FUA, Apex, NC    |
|  CK Chuck, K4HF - Raleigh    |  DN Doug N3LTV Raleigh NC           |  RW RICK WARD KO4JMZ Clayton    |
|  N n4mqu                     |  EW Ernesto, W0KES, Raleigh         |  RK Rob K4RWR - Raleigh         |
|  WW WD4RDT Wilbur            |  EB Ernie Bauer N4AEW Youngsville   |  Ryan - N7RYN                   |
|  AG AJ4YA Grady. Wendell,NC  |  Greg KE4PAX                        |  SH Sam Harris                  |
|  AA Alan AB4OZ RALEIGH       |  Hank K4HM Florida                  |  SK sam. KN4RWI                 |
|  BD Ben Davis KN4RFT       |  JK Jerry KE4TTS Cary, NC         |  T Terence Passey             |
|  BK Bob K4RLC              |  JK Jim KM4WRK, Raleigh           |  TN Tom NC4TS                 |
|  BN Bob NC1X Raleigh       |  Joe N4BJH Wake Forest            |  TO Tony O'Connor K1OC - Cary |
|  BW Bob, W4GIA             |  JR Joe Rymer                     |  WR W4WHW-Bill Raleigh        |
|  BN Bob. N4GEB             |  Julie Gustasson (WE3T) - Raleigh |  WR W8TWT, Raleigh            |
|  BK Brantley K4CBW Raleigh |  JR Julie Royster KT4JR           |  WA Walker Armistead KD4YJX   |
|  CD Carl Davis             |  LK Lowell K4EUP Wendell          |  WW WD4RDT Wilbur             |
|  CG Charles Good           |  MK Murray, K4MHM, Raleigh, NC    |                                                                                                                    |

50 people attended the zoom meeting

## Future RARS Meeting Topics

Titles, topics, and speakers **subject to change**.



| Date      | Topic                                                    | Presenter                              |
|-----------|----------------------------------------------------------|----------------------------------------|
| 4/12/2022 | Bridgecom DMR Presentation                               | Josh Landewee                          |
| 5/10/2022 | AUXCOMM                                                  | Virginia Enzor, NC4VA                  |
| 6/14/2022 | Field Day                                                | Field Day Chair<br>Curt Phillips, W4CP |
| 7/12/2022 | "Mid-air Refueling Mission & Communication Methods Used" | Joe Owen K4HEW                         |
| 8/9/2022  | Small resonated HF Loop Antennas                         | Richard Quick, W4RQ                    |
| 9/13/2022 | "Things hams were taught that aren't true"               | Chuck Till, K4RGN                      |

During the Zoom meetings please keep  
your microphone muted.

Please edit your name so your  
Name, Call and Location are shown.



## RARS Membership links

Use the following link to verify / update your membership profile.

<https://www.rars.org/userprofile.php>

Use the following link to renew your membership.

[https://www.rars.org/membership\\_renewal.php](https://www.rars.org/membership_renewal.php)

---

## HAM RADIO LUNCHEON

*Everyone is welcome!*

Every Thursday at 11:30 am

New York Diner, 909 McKnight Drive Knightdale.

<https://www.facebook.com/NewYorkDinerNC>

Check the latest information on the AB4OZ QRZ entry.

[QRZ.COM](https://www.qrz.com).

---

## Hamfest Calendar

For details go to <https://www.arrl.org/hamfests/search>

## Free AB4OZ Hamfest, Weather permitting

The free AB4OZ Hamfest will be Saturday, May 21, 2022. Setup at 9AM. Start time is 10AM. New location, Golden Corral Restaurant rear parking lot. 3551 Grenelle street, Raleigh NC 27603.

Check the latest information here [QRZ.COM](https://www.qrz.com).

---

<https://www.rars.org>

## RARS Member Birthdays & New Members

### Member Birthdays

|                |        |       |
|----------------|--------|-------|
| Bill           | KO4IBN | 04/01 |
| Devin          | KN4FVH | 04/01 |
| Roger          | KB4FEU | 04/02 |
| Rob            | KM4MLY | 04/03 |
| Bob            | W4TTX  | 04/03 |
| Patrick        | KN4YEH | 04/04 |
| Anna           | KO4SHN | 04/07 |
| Garry          | KM4MMC | 04/07 |
| Ginger         | KD4OKP | 04/08 |
| Julia          | KT4JR  | 04/09 |
| Keith Buchanan |        | 04/10 |
| Dennis         | NC4DK  | 04/10 |
| Bob            | K2QJ   | 04/11 |
| Dave           | K4KDP  | 04/13 |
| Thomas         | N4IZE  | 04/15 |
| Tom            | NC4TS  | 04/15 |
| Cindy          | KB8LVU | 04/15 |
| Ryan           | N7RYN  | 04/17 |
| Charles        | KM4MBS | 04/17 |
| Michael        | KD4FRD | 04/18 |
| Larry          | W4LEC  | 04/19 |
| Kirk           | KI4RK  | 04/19 |
| John           | W4WWD  | 04/20 |
| Peter          | K2AXI  | 04/21 |
| Fin            | NC4FG  | 04/22 |
| MO             | KO4WIV | 04/22 |
| Troy           | KN4WSO | 04/22 |

### Member Birthdays

|         |        |       |
|---------|--------|-------|
| Joanne  | AK4RJ  | 04/23 |
| Pete    | KI4LWQ | 04/23 |
| Dave    | KG4OPZ | 04/24 |
| Patrick | W4NMS  | 04/25 |
| John    | K4RUF  | 04/27 |
| Glen    | KE4NPZ | 04/27 |
| Charlie | WA4OSS | 04/27 |
| Joe     | KT4JOE | 04/27 |
| Kirk    | KM4RHF | 04/27 |
| Tad     | K3TD   | 04/28 |
| Michael | KD4OKR | 04/29 |
| Stan    | W2CK   | 04/29 |
| John    | NC4JP  | 04/29 |

### New Members

|                 |              |
|-----------------|--------------|
| Todd McBride    | KD4SOU       |
| Diane Hollar    | KC3HNG       |
| Michael Burbage | KO4YMG       |
| Dan Daniel      | Not Licensed |
| Dan Daniels     | WA3CUC       |
| Ken Bolin       | KG7CCT       |
| Linda Bolin     | Not Licensed |
| Sam Harris      | Not Licensed |
| Alan Porter     | KR4JB        |
| Greg Savage     | W7GMS        |

## The RARS Portable Operating Group's inaugural



The RARS Portable Operating Group's inaugural outing took place on March 26 at Umstead State Park. Around 20 people gathered in the large Reedy Creek shelter for a portable show-and-share event as well as a satellite demonstration. The weather was more than cooperative. Participants included several new licensees as well as some experienced Parks on the Air operators.



Our aim was to show the wide variety of portable operating styles and equipment. Several attendees presented their portable rigs while fielding questions from the crowd. We then set about making some HF QSOs.

Midway through the event, John Brier KG4AKV demonstrated satellite operating. He set up near the parking lot, where views to the horizon were best, and worked two FM satellites and two linear satellites in a little more than hour.

For HF operating, four or five different portable rigs were present, including several Yaesu and Icom models. Antennas for the day included a random wire, end-fed halfwave, and a Chameleon vertical antenna. Antenna analyzers were on hand to confirm assumptions. Band pass filters made the whole event possible.

Phone was the most popular mode, although CW did make an appearance to snag a QRP QSO.

This event was a great success, and I look forward to the next one in April. Join us then!

Brantley K4CBW

## Interesting information

3D printing presentation from our January meeting.

By Paul Holzworth, KD4BFN

<https://www.rars.org/exciters/2022/3D-Printing-RARS.pdf>

Demystifying Software Defined Radio by Daniel DeSantis KC3FKR

51 minutes, click on **Browse YouTube** when the site opens up.

<https://www.youtube.com/watch?v=GrlfqAgej8>

Southern Africa Antique Wireless Association

<http://www.awasa.org.za/newsletters/147-newsletters-2022>

Thanks to Brian Harrison KN4R for sending this to the Exciter

Lots of Heathkit Information

[https://www.w6ze.org/Heathkit/Heathkit\\_Index.html#miscTNs](https://www.w6ze.org/Heathkit/Heathkit_Index.html#miscTNs)

Building an antenna? Metals Supermarket in Durham, NC.

Thanks to Jim, W4TMO,

2310 Presidential Dr. #106, Durham, NC 27703

Walk in, tell em what you want. They'll cut to length, put it on a scale and only charge for what you want. If you want, they'll take you out in the warehouse and let you "shop" on your own.

<https://www.metalsupermarkets.com/about/>

The NC QSO Party results are in

<https://ncqsoparty.org/results-2/results2022/>

Blowing up capacitors and slow motion photography.

<https://www.youtube.com/watch?v=6WUxgmMDts4>

RATPAC

Radio Amateur Training Planning and Activities Committee

<https://sites.google.com/view/ratpac>

---

## RARS Monthly Dinner, NEW LOCATION

All members and guests are welcome to the monthly (first Tuesday) RARS Supper, 6:30PM, at the CHOW Restaurant, 8311 Creedmoor Road, Raleigh. The restaurant is at the corner of Brennan Drive and Creedmoor Roads, behind McDonalds. After entering the restaurant, go to the left rear to the private room. Informal and Dutch, just bring your appetite and best rag to chew. "Your attendance will help us retain the private meeting room."



---

<https://www.rars.org>



## RARS Classifieds

Copied from <https://www.rars.org/classifieds.php>

The items below were listed within the last 30 days on the RARS website.

Check the RARS Classified List on the RARS website regularly for new items.

---

### **Flex 3000 SDR Transceiver Package**

Posted March 16th, 2022 by: KN4RFT

Contact: [kn4rft@gmail.com](mailto:kn4rft@gmail.com)

I have For Sale my Flex 3000 SDR Transceiver; 160 meter to 6 meter, 100 watt output, all modes, built in tuner capable of matching up to 3:1 SWR mismatch. Also included are 1 Dell PC (i-5 3.2ghz Processor, 8gig RAM, 1 TB harddrive with Windows 10 and a Firewire card installed), 1 FlexControl Knob, 1 hand mic, 1 mic/ptt adapter from W2ENY, Firewire cables, and 1 set of powered external speakers. The Flex 3000 was recently inspected by Troy Radio of Troy Texas, an authorized repair shop for legacy Flex products, and the PA was recalibrated to provide 100 watts output on all bands.

The PC comes loaded with PowerSDR by KE9NS, who has continued to update and improve on the original PowerSDR.

This is a great radio and I'm very pleased it was my introduction to operating an SDR. I am no longer using this transceiver after upgrading my primary HF radio to a Flex 6400.

The radio and PC are currently hooked up at my QTH and available for demos.

Price: \$850 obo for the package.

Thank you,  
Ben Davis KN4RFT  
[kn4rft@gmail.com](mailto:kn4rft@gmail.com)  
919-906-7844

## RARS Classifieds continued

### **ALS-1300 Solid State No-Tune Amplifier**

Posted March 13th, 2022 by: NC4EN

Contact: [nc4en@arrl.net](mailto:nc4en@arrl.net)

ALS-1300 solid state no-tune amplifier. 1200 watts. ARI-500 remote and manual included. Asking \$2000.00. You can pick it up or we can meet for exchange.

---

### **FS: Hallicrafters SX-17**

Posted March 11th, 2022 by: W4BOH

Contact: [infomet@embargmail.com](mailto:infomet@embargmail.com)

Very presentable and fully functional, \$200.

---

### **FS: Yaesu VX-6 HT**

Posted March 11th, 2022 by: W4BOH

Contact: [infomet@embargmail.com](mailto:infomet@embargmail.com)

Very clean VX-6 for sale.

Believed fully functional but needs battery.

Located Hillsborough can be picked up or mailed, \$50.

Wilson

W4BOH

---

### **two items for sale**

Posted March 9th, 2022 by: N4TL

Contact: [n4tl2@yahoo.com](mailto:n4tl2@yahoo.com)

1. Russound, SS-6, stereo speaker section box. Up to six speakers can be turned on or off. For multi room installations. Handles 70 watts per channel, \$40
2. Behringer, RX1602, Audio equipment, Professional 16 input low noise line mixer, with users manual, \$50.

Contact Tom, N4TL, [n4tl2@yahoo.com](mailto:n4tl2@yahoo.com) or [n4tl2tom@gmail.com](mailto:n4tl2tom@gmail.com)

---

## RARS Classifieds continued

### two items for sale

Posted March 9th, 2022 by: N4TL

Contact: [n4tl2@yahoo.com](mailto:n4tl2@yahoo.com)

1. ICOM IC-SM6 Microphone, \$40.

2. ICOM SP-20 Speaker in original box. Looks new. Has two inputs that are selectable on the front. Also has HP and LP filters. \$75.

Contact Tom, N4TL, [n4tl2@yahoo.com](mailto:n4tl2@yahoo.com) or [n4tl2tom@gmail.com](mailto:n4tl2tom@gmail.com)

---

### 70s-80s Motorola & GE HT service manuals free to a good home

Posted March 7th, 2022 by: KI4PUT

Contact: [dhinson@sjmail.us](mailto:dhinson@sjmail.us)

I have a collection of Motorola & GE factory service manuals from the mid-70s to mid-80s era I'd like to give away to somebody who can genuinely appreciate them. These are from a hard-working authorized repair shop from that era. As such you can expect them to be in a wide range of conditions complete with coffee stains, cigarette ashes, scribbles, nose hairs, etc. So they are for technical reference not collectors. However they are chock full of original schematics and service procedures.

Hi-res photo <https://retro-radio.s3.amazonaws.com/ShopManuals.jpg>

Email me if interested,

David  
Holly Springs  
KI4PUT

## January RARS Board Meeting Minutes

**18 January, 2022** - 7 PM via Zoom

In attendance:

John N8ZU, Tom N4TL, Alan AB4OZ, Tadd KA2DEW, Carl W8WZ, Hank K4HM, Chuck K4HF, Jeremy K2HJX, Ken AD4GX, Curt W4CP, Greg KE4PAX, Julie NC4JR, Joe WA4GIR, Brantley K4CBW, Nancy KB2TNR.

Call to Order:

John called the meeting to order at 7:00 PM.

A quorum was present and past minutes were approved.

John initiated a discussion concerning the proposed questionnaire changes to the membership form. Hank outlined the work he has already done surrounding suggested modifications. Greg noted that we weren't doing much with the current data. Jeremy indicated that he is using the data for public service.

Old Business:

- \*Nancy will investigate the physical feasibility of the hamfest. And will get a feel for staffing requirements.
- There is a question as to the food service for RARSfest. To be addressed later.
- Greg returned to the subject of offering a new level of membership for students.  
\*Discussion tabled until John sends an e-mail to the BoD.

New Business:

- \*Hank, Greg and Mark will compile a list of changes to present to the board. Item will be tabled temporarily, until said list is complete.
- John raised the question of when we should starting meeting in person, and noted that there is no practicality in meeting next month, based on the discussions with the church. The discussion is tabled until next month.
- Hank came up with a document dealing with NC non-profit regulations. \*John and Hank will set a link to the doc for all the board to see.

[Jump back to page 5](#)

## January RARS Board Meeting Minutes continued

- John brought up the idea of having a volunteer coordinator. Jeremy volunteered to take that position if implemented. He also created a corresponding document, describing the duties of that person. The proposal is postponed until after RARSfest.
- Jeremy presented a proposal to separate the Public Service activities from the RARS club. In the past, a group, HPSNC has operated the public service activities. RARS would maintain the ownership of the separate web site and the current link on the RARS website would point to the new website. Karl added that RARS foot the bill and that the PS director have full access. For simplification, the proposal has been included below.

““You may be aware that under my predecessor, John Stone (K3RLH/SK), the RARS public service component operated as HPSNC, a RARS committee but with a degree of separation from the club. I do not know the full history of the HPSNC formation, but my understanding is that this arrangement would help to attract a wider volunteer base that includes hams from other clubs around the region. The attached 2017 proposal to the Board best summarizes the idea. The earliest use of the name I have found appears in a notice in the attached November 2013 Forsyth Amateur Radio Club Newsletter (p. 2).

John used a rudimentary HTML site where volunteers could sign up, get event day info, and download documents about being a ham volunteer. I would like to return to the use of HPSNC as an organizational and recruiting tool with a modernized website. To that end, I have secured the HPSNC.org URL. I have created a new website at <https://www.hpsnc.org> which is live but hidden from search engines at this time. The link will take you there as will entering the address in your search bar. Please take a look. The cost of the site is minimal and I will continue to cover it.

You may recognize the HPSNC logo from the picture I sometimes use during zoom meetings when my camera is off. You may have also seen it elsewhere in RARS documents or in your volunteer activity. As far as I know, John Snellen (AI4RT), who preceded John Stone, created the graphic. I have found only one other entity, ham radio related or otherwise, using “HPSNC”. It is a non-profit horse rescue called Horse Protection Society of North Carolina, Inc. Its URL is <http://horseprotection.org>. There seems little chance of confusion between the two.”“

After the revised wording, the motion was passed unanimously.



## January RARS Board Meeting Minutes continued

### Officer Reports:

- VP Report – Next months program will be will be “A Comparison of the Icom 7300 and the Yaesu FTDX-101D”, By Gary Schwartz. The next will be “Fuel Tanker Communications” Looking for future presentations.
- The Secretary was absent so no report was given.
- Treasurer – 406 members. Greg presented assets and inventory and RARSfest expenses. Income included proceeds from some equipment sales and doughnut sales at the State Fair. Also monies from the QSO party. Taxes have been sent.
- Public Service Director – \*Jeremy will update the Facebook page.
- The Education Director - No report
- The Field Day Chair - Planning is going well. Most of last years will be contacted for this year.
- Repeater Chair - Did site surveys. Alan shot video under the shed to investigate the problem with the floor tiles coming up, but found no problems at the Bayleaf site. \*Greg will follow up with Chuck DeCourt dealing with the phone issue.
- RARSfest Chair - is vacant so no report.
- Exciter Editor Tom N4TL - Input due by Jan. 29.
- Food Service Director - No report.
- Net Manager Julie KT4JR – No report.
- ARRL Liaison Chuck K4HF – Dr. Jim Boehner contacted Chuck and congratulated RARSfest as being the Roanoke Division Convention this year. And is looking forward to being here. Bill Morine will support us as well.
- NCQP Chair – Going well.
- VE Team Leader Joe WA4GIR – Planning a VE session for RARSfest.
- Webmaster Hank K4HM – Has not heard from Devon Hedge. \*Hank will contact him. Has made some modernization changes to the web site. Created a database ,update, log-file. Added the PS Chair job description to the web page.

## January RARS Board Meeting Minutes continued

- Youth Director Brantley K4CBW – Gave an update on Solar Pack team at NC State. They have already begun testing. A build-a-thon program is upcoming. Working on Winter Field Day. \*Brantley will contact John Brier to discuss details.
- At large Director AB4OZ – Suggested Brantley contact new HAMs to be pointed to the repeater etiquette document.
- At large Director Tadd KA2DEW No report.
- At large Director Ken AD4GX No report.
- Carl reported, as trustee, that all is well. W4DW will be used for Winter Field Day. Greg noted that an additional person can be added to assist the Trustees. \*Carl will look into that. RARS gets the SERA Journal rather than the individual Trustees.

### **Additional comments:**

John returned to Jeremy, who outlined his updated proposal, which, again is included below. After a Q&A, John motioned that the reference to John Stone be removed.

The board approved the motion.

"Motion to establish the Ham Public Service North Carolina (HPSNC) group as a RARS committee. HPSNC will operate a separate website for the recruitment and organization of volunteers for public service events. The website will become the property of RARS with full access thereto to the RARS Board and any successor Public Service Directors. The RARS Public Service Director and HPSNC committee will manage the HPSNC website and volunteer activities. Other radio clubs may become co-sponsor of the HPSNC group and appear on the HPSNC website and promotional materials."

Nancy Torborg gave an update on the progress of planning RARSfest.

\* denotes an action.

The meeting adjourned at 9:06.

Respectfully Submitted,

Mark Kilmer,  
Secretary.

## February RARS Board Meeting Minutes

**15 February, 2022** - 7 PM via Zoom

In attendance:

John N8ZU, Tom N4TL, Alan AB4OZ, Tadd KA2DEW, Carl W8WZ, Hank K4HM, Chuck K4HF, Jeremy K2HJX, Ken AD4GX, Greg KE4PAX, Julie NC4JR, Brantley K4CBW, Nancy Torborg KB2TNR.

Call to Order:

John called the meeting to order at 7:00 PM.

A quorum was present and past minutes were approved.

Old Business:

John opened the meeting in reference to the previous discussion of the addition of a student membership category. After researching the bylaws, John found a way too add the new dues category without amending the bylaws. The proposed motion was approved by the Board and will go before the membership at the next meeting for ratification. \*John will add to the agenda. \*Jeremy will send the proposal to all Board members.

Text of the revised motion:

“MOTION: to establish a dues rate of \$12/year for licensed full-time students, who shall be admitted as FULL members and enjoy the rights and privileges thereof. ‘Full-time student’ is as defined by the institution at which the student is enrolled.”

New Business:

John raised the question of when we should starting meeting in person, and noted the new numbers associated with the pandemic status. For Wake County. Carl made the following suggestion;

“The regular monthly meeting of RARS continues to be conducted via zoom indefinitely. RARS will also have an informal in person monthly gathering at our usual meeting location on a day other than the official meeting for anyone who wants to attend. \*KA2DEW will lead this meeting.” A motion was made and passed. \*John

## February RARS Board Meeting Minutes continued

will contact the church to investigate scheduling.

### Officer Reports:

- VP Report – Tom presented the upcoming meeting topics.
- The Secretary – No report..
- Treasurer – 409 members. Greg presented assets, inventory and RARSfest expenses. As well as an expense from the repeater, budget. Income associated with RARSfest.
- Public Service Director – Season is looking good.
- The Education Director - No report
- The Field Day Chair - Planning is going well.
- Repeater Chair - Alan has been working with Chuck DeCourt on an ongoing project.  
\*Alan is planning to take more pictures of the Bayleaf shed flooring.
- RARSfest Chair – Ticket and tables have started coming in. All major positions are filled.
- Exciter Editor Tom N4TL - Going well. Tom received a couple of W4DW QSL cards and has returned/processed them. John asked for vendor detail for RARSfest.
- Food Service Director - No report.
- Net Manager Julie KT4JR – No issues with the nets.
- ARRL Liaison Chuck K4HF – We may know soon who has won the election for section manager. Bill Morine and the new section manager will represent the ARRL for RARSfest.
- NCQP Chair – Made some minor changes to the rules.
- VE Team Leader Joe WA4GIR – No report
- Webmaster Hank K4HM – Has made general updates to the website including significant changes for RARSfest and work on the mail system. Hank is working to recruit vendors who he met at HamCation.

## February RARS Board Meeting Minutes continued

- Youth Director Brantley K4CBW – Excellent Winter Field Day. Brantley visited the W4ATC shack. Proposed to “Have RARS establish a Portable Operating Special Interest Group for the purpose of demonstrating ham radio in public, and preparing hams to operate beyond the conveniences of home stations.” Alan suggested that local hamfests would be an ideal setting for the portable setups. The board voted and the proposal and was carried.
- At large Director AB4OZ – No report.
- At large Director Tadd KA2DEW No report.
- At large Director Ken AD4GX No report.
- Carl reported, as trustee, that all is well and Tom gave permission for W4DW, to Brantley for the Winter Field Day.
- Chuck put out a request to have any ideas for the club awards by Feb. 22.
- Greg suggested the idea of having two of Tadd’s sessions before RARSfest in an effort to garner more interest for the event. He also noted that Marty Young will be receiving an NCQSO award this year.

\* denotes an action.

The meeting adjourned at 8:52 PM.

Respectfully Submitted,

Mark Kilmer,  
Secretary RARS.

## March RARS Membership Meeting Minutes

**8 March 2022 - 7 PM via Zoom**

**Call to Order:** John Honeycutt

Pledge of Allegiance recited.

John invited guests, new members and upgraded licensees to introduce themselves.

We had one visitor.

A quorum was present.

February minutes approved.

New Business

- John and Chuck announced the winners of this year's RARS Awards.
- Brantly West brought before the club, a motion to implement a new student membership rate. (Approved previously by the BoD. Text below:

Text of the revised motion:

"MOTION: to establish a dues rate of \$12/year for licensed full-time students, who shall be admitted as FULL members and enjoy the rights and privileges thereof. 'Full-time student' is as defined by the institution at which the student is enrolled."

The club voted to approve the motion.

### **Officer Reports:**

- President – Next BoD meeting will be held next week @ 7:00 PM. Contact one of the officers for the Zoom login. Also, if a slot is needed on the agenda, contact John directly.
- Vice President – Announced upcoming meeting presentations.
- Secretary - [No report.](#)
- Treasurer – 418 current members. Greg covered assets, income and expenses, including the bill for Deltaforce (web services) and fees to Ridge Road Baptist church.
- Repeater Chair - No report.
- Exciter Editor – Going well.
- Net Manager - No report.

[Jump back to page 4](#)



## RARS Membership Meeting Minutes – continued

- The Public Service Director – Jeremy indicated that the first event was a success, and noted upcoming events.
- Field Day Chair - No report.
- ARRL Liaison - No report.
- Education Director - No report.
- Youth Director – Brantley West noted upcoming youth events. He also brought up the next activity for the “Portable Operating Group”. John Brier will be present to do a satellite demo.
- At large director - Alan Pitegoff – Announced upcoming hamfests. Information can be found on his QRZ page. (AB4OZ) Alan also indicated that people should not announce vacation information on the nets.  
At large director – Ken Latchum - No Report.
- At large director – Tadd Torborg – Announced his new “in-person” meeting, which will offer a “Science Fair” type format. This will replace the old “New HAM” meeting.

Additional comments:

John announced the clubs 53<sup>rd</sup> anniversary.

### **Program**

Tom Lewis introduced tonight’s program, “Rarsfest 2022”. Presented by Nancy Torborg. (KB2TNR)

The meeting adjourned at 8:57 PM Eastern Time.

Respectfully Submitted,

Mark Kilmer

RARS Secretary

# End Fed Half Wave Antennas

Perhaps better called End Fed Multi-Band Antennas

By: Carl Davis, W8WZ with thanks to John Brier, KG4AKV for assistance with editing

March 2022

## *History*

Some of the earliest antennas used in radio communications were “end fed” or voltage coupled antennas. This was because it was simple to attach the antenna directly to the transmitter’s final RF output section and get on the air. You can see this usage of antennas in radio literature from the 1920’s. This was before a lot was known about antenna design. These early antennas were not particularly efficient and would not work with today’s transmitters which require a low standing wave ratio given by a nominal 50-ohm impedance. However, they are part of our radio heritage and show us that the idea of an end-fed antenna is not new. An end fed antenna design that came along later than those early end fed wires, but still relatively early in the history of radio, and is still in use today, is the “Zep”, which is short for “Zeppelin” antenna. This antenna was originally designed during the days of the zeppelin airships and was designed to be trailed behind the airship as it flew and was end fed from the transmitter located on the airship. Like the other early end-fed antennas, the Zep had no feedline. The antenna itself connected to the radio. The Zep antenna consists of a half wave resonator fed against a quarter wave counterpoise which is parallel to the resonator. These antennas are still used on HF occasionally, but are most often used these days on VHF and UHF in a vertical configuration known as the “J-Pole” and, unlike their airship ancestors, do accept a feedline for the sake of practicality. However, other than the J-Pole or Zep, end-fed antenna systems fell out of favor as radio technology evolved. During the 1930s to 1950s we learned that resonant antennas fed at voltage nulls (and therefore current maximums) were generally more efficient and our newer radio designs began to require effective RF coupling to preserve their final amplifier stages. Therefore, end-fed antennas that were voltage coupled fell out of favor around the 1950’s. With those who still used them having to use impedance matching networks (aka antenna tuners) and often deal with issues such as “RF in the shack” and increased likelihood of RFI to household electronics. I am reminded of a fellow ham I knew when we were both in high school whose antenna was an end fed random wire. He kept a rubber kitchen dishwashing glove on the radio desk and put it on when he used the radio so that he didn’t get an RF burn from his D-104 microphone. End-Fed antennas came to have a bad reputation due to these realities. All of this changed recently as technological advancements in metallurgy allowed the development of new transformers using toroid cores that allow us to effectively voltage feed an antenna with great efficiency.

## *Nomenclature*

Sometimes it is confusing to talk about antennas because different people use the same term to

mean different things. For the sake of clarity, I will address the terms I am using.

*Coupling:* One benefit of looking at the early radio station diagrams in my late grandfather's radio books from the 1920's, is that they show (rightly) that the antenna is an integral part of the radio station. Today we tend to think in terms of "radio" and "antenna" as separate things that merely get connected together using some sort of feedline. I think it is better to keep the older, more holistic, view that the entire station from AC input into the power supply to RF output via the antenna into the ionosphere is one big system. It was easier to see this reality with older type transmitters. When we look at one of those transmitters we begin with the power supply, then move to the oscillator where an RF signal is created. Then that signal gets coupled into the next RF stage for amplification (or perhaps doubling), then the RF may get coupled to another stage for further amplification (or doubling), and the signal then goes into the final amplifier stage where the RF is at its maximum value and ready to go into the antenna system. Coupling between stages occurred by adjusting the values of inductance (L) and capacitance (C) in the circuit to achieve resonance. All of this being fundamentally based on the formula: Resonant Frequency equals  $1 \text{ divided by } 2 \text{ times } \pi \text{ times the square root of } L \text{ times } C$ . Therefore, we can couple RF from one stage to the next by making adjustments to L (inductance) and/or C (capacitance) in each stage of the circuit. As the RF generated in the oscillator was coupled to the next stage of the transmitter, we could see that this coupling happened from one stage to the next by looking at the rig's ammeter, and observing the dip in current as the energy moved from stage to stage. Finally, we used the same method of adjusting L and C values to couple the RF into the antenna system, and again observed a dip in current when the RF coupled from the transmitter into the antenna system (which consists of the antenna and, when used, the feedline). If the RF didn't couple into the antenna system, adjustments to the antenna system needed to be made to allow coupling by the L and C component values used in our matching networks. Radios today function in the same basic way. However, because now all we do is press a button on a radio and instantly have 100W coming out the back of the radio, it is easy to overlook this process of RF coupling from stage to stage and thereby think of the radio as one unit that simply "makes RF" and the antenna system as an entirely different unit. However, when designing an antenna system, it is helpful to think in terms of RF coupling from stage to stage in the radio station. The antenna is simply the final stage in the system into which RF must be effectively coupled. Today we need to effectively couple the RF from the back of our transceiver into an antenna system. The science behind how that RF is coupled is the same as it has always been. The old formulas remain the same. When the antenna is resonant on a given frequency we are able to effectively couple RF into it and this occurrence can be observed by measuring a low voltage standing wave ratio. This is why hams are always looking for a "low SWR". It is also very possible to couple RF into non-resonant antennas as well, but that is beyond the scope of this article. Too often hams use the terms "low SWR" and "resonance" to mean that RF is effectively coupled. While those can be indicators of effective RF coupling into the antenna system, none of these terms are truly synonyms and should not be interchanged.

*Current Coupled vs. Voltage Coupled (also called Current Fed or Voltage Fed):* Voltage and Current have an inverse relationship. That means when one is high the other is low and vice versa. In a half wave antenna, voltage is high at the ends and low in the center. Current is high in the center and low at the ends. Therefore, when this antenna is fed in the middle it is said to be current fed and when it is fed at

the end it is said to be voltage fed.

*Dipole:* Historically this term has been used to mean a half wave antenna that is current fed (in the center) with one quarter wavelength on each side of the feed point. This is the “gold standard” antenna against which all other antennas are historically compared. Traditionally, this antenna is hung parallel to the earth with its feedline hanging perpendicular to the antenna. It can be hung in other configurations such as an “Inverted V” where the feedline is the highest point and both legs of the dipole taper down to the earth forming the shape of an inverted V. This changes the radiation pattern but has minimal effect on RF coupling. The antenna, when used in this configuration, is generally called an “Inverted V” not a simply a “dipole”. Also, this antenna can also be hung with one leg higher than the other, but still in a flat top configuration. This is called a “sloper” and has a different radiation pattern, but generally couples RF into it like a normal dipole does. When we talk about an antenna’s gain, unless otherwise specified, we mean, compared to a half wave center fed, dipole, hung parallel to the earth with the feedline hanging perpendicularly. Recently, however, the word dipole has been used to refer to any half wave antenna. I do not like this new use of term as it makes the term less effective by allowing it to mean more than one thing. Not every half wave antenna is a dipole. Therefore, I do not consider end-fed half wave antennas to be a dipole and will not refer to them as such, although others do.

### *Enter the End-Fed Half Wave Antenna*

It is hard to couple RF into the end of a half wave antenna where the voltage is at its maximum. The impedance is very high. The exact impedance will fluctuate depending on many, variables including, feed point elevation, proximity to other objects, soil conductivity and more. It is generally understood to be in the range of 2,000 to 4,000 ohms in most cases. Since our modern transmitters are expecting an approximate impedance of 50 ohms, an impedance matching network is needed to transform the radio's 50 ohms to the antenna's 2K ohms or more. There are several different options to do this. The most common being the 49:1 transformer as  $49 * 50 = 2,450$ . The transformer consists of 2 primary windings and 14 secondary windings. This gives us a ratio of 1 to 7. The voltage coming out of the transformer is therefore seven times higher than the source voltage and the current is seven times lower than the source current. This results in an impedance

transformation of  $7 * 7$  which is 49. As noted above,  $49 * 50 = 2,450$ . Therefore, our matching transformer increases the impedance of 50 Ohms by a factor of 49 for a total of 2,450 Ohms, thus allowing the RF from our radio to couple into our End-Fed (voltage coupled) antenna with great efficiency.

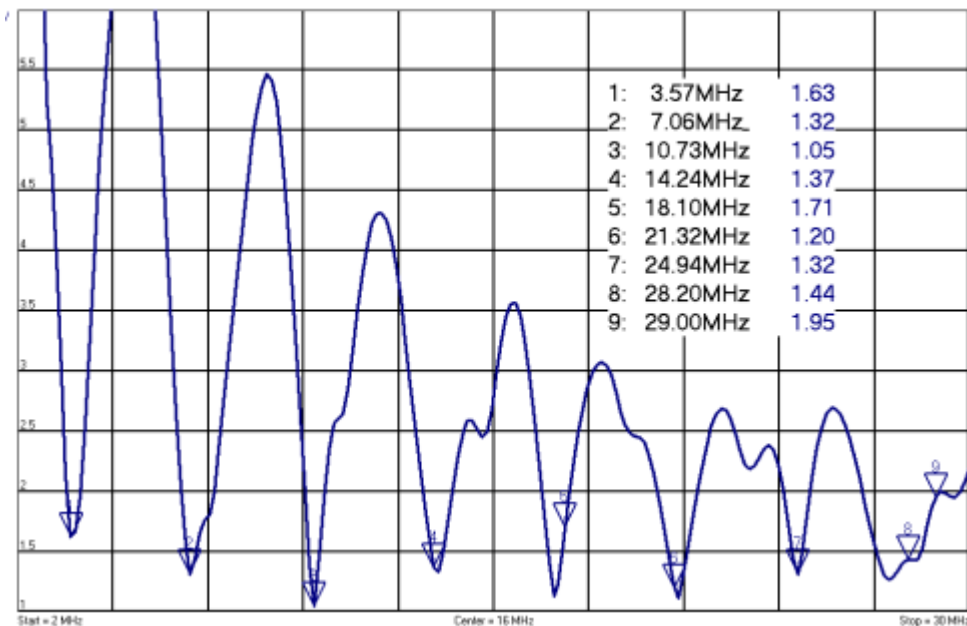
Thanks to modern ferrite core transformers, we can do this easily. The days of end fed antennas being hard to couple are over. It is worth pausing here to note that antenna and radio impedances do not need to be perfectly identical in order to match. They just have to be close enough. For instance, the gold standard dipole has an impedance of just above 70 ohms at its feed point when mounted at a text book half wave elevation in free space. However, we couple it directly to a 50-ohm radio with no problem as that

difference is very small, so they still are considered to be “impedance matched” and the RF couples without any issue, even though one is nominally 72 ohms and the other is nominally 50 ohms.

### The Magic of Related Harmonics

Since the amateur bands are harmonically related this End-Fed Half Wave antenna can actually be used on bands higher than its designed frequency. We call it an end-fed half wave but that name is only accurate when using it on its designed frequency. If you have a half wave on 80 meters, you have a full wave on 40 meters, two full waves on 20 meters, etc. This mathematical relationship allows this antenna to effectively couple RF on the antenna’s designed frequency where it is a half wave long, and also the higher bands where there is a harmonic relationship. This is what makes this antenna very special. One wire, can be used on many bands with ease. RF couples well as the impedance remains high on those higher bands so the transformer works. It is important to know that while the antenna will couple RF on the different bands, it will have different radiation patterns on the different frequencies as lobes will form differently along the wire as the RF is at different wavelengths. It might be more accurate to call this antenna an “End-Fed Multi band Antenna” as it is only an “End-Fed Half Wave” when using it on its lowest designed frequency.

Here is a chart of the SWR on various frequencies as created by the [myantennas.com](http://myantennas.com) company followed by a table showing my own SWR measurements of the antenna installed at my home.



The data table below is as it is measured at W8WZ:

| Frequency | SWR from webpage | SWR Measured   |
|-----------|------------------|----------------|
| 3.57      | 1.63             | 1.2            |
| 7.06      | 1.32             | 1.8            |
| 10.73     | 1.05             | Not a ham band |
| 10.1      | Not on webpage   | 3.1            |
| 14.24     | 1.37             | 1.0            |
| 18.10     | 1.71             | 1.7            |
| 21.32     | 1.20             | 1.5            |
| 24.94     | 1.32             | 1.2            |
| 28.20     | 1.44             | 1.5            |
| 29.00     | 1.95             | 3.5            |

As you can see my measurements closely align with the predicted results from the [myantennas.com](http://myantennas.com) webpage. Obviously, each installation will have some slight variation.

#### The Devil is in the Details

As you might imagine, not all impedance matching transformers are created equally. There are several issues to consider when choosing a transformer. The first is power handling capability. Different types of ferrite materials have different power ratings. As you might expect, the ones that handle more power are more expensive. FT43 cores are lower cost but handle less power. FT52 cores are more expensive but handle more power. Multiple cores can be glued together with super glue, or tied together with zip ties to increase their power handling ability. Steve Ellington, N4LQ has excellent explanations on how to build these transformers on YouTube and on his "End Fed Antennas" Facebook Group. I followed his instructions using three type 52 cores for maximum power handling abilities. The kit available from the ARRL uses only one torroid and I do not know if it uses a 43 or 52 mix. I would be cautious when using it with more than 100 Watts SSB. But since many hams are SSB only users and run only 100 Watts, that transformer should meet their needs well at a relatively low price point, and is therefore a good product to have in the marketplace. But, contesters who run 10 hours of CW might find it lacking.

I have observed is that the transformers purchased from [myantennas.com](http://myantennas.com) seem to be less impacted by different installation details and are more broad banded in that they provide wider portions of the band where the RF will couple than the ones I have made. Both work extremely well, however after many different experiments, the transformer from [myantennas.com](http://myantennas.com) always seems to be less impacted in its ability to effectively couple RF into the wire by things such as the height of the matching transformer



above ground, or by the height or pattern of the radiating wire. Also the window of usable bandwidth tends to be bigger. I believe this may be because [myantennas.com](http://myantennas.com) uses larger sized toroid cores. Their toroid cores are 2.9 inches in diameter as opposed to the 2.4 inch diameter toroid cores used in my home made units. Other than that, they appear almost identical, so that is the only explanation I have for their slightly different performance. My advice to people looking for this type of antenna is, if you just want an antenna that works and don't mind paying for it, buy the antenna from [myantennas.com](http://myantennas.com). However, if you enjoy building, like experimenting and tinkering, then by all means build away, as this is a very fun unit to build and use.

### Power Handling

One question that almost always arises when talking about antennas is “How much power can it handle?” this is a hard question to answer because we don't have a single, universally used definition of power rating. We really can't have such a definition because different modes and different duty cycles impact the answer dramatically. Traditionally, radio parts are rated either using “ICAS” or “CCS” labels. Myantennas.com, like many other manufacturers, uses the an ICAS rating on their product's power rating. ICAS stands for “Intermittent Commercial and Amateur Service.” Two way radios in a taxi cab would be an example of an intermittent commercial service. We are, of course, familiar with the Amateur Service. Radio parts for these applications get labeled using an ICAS rating. The idea is that in these services the radios do not transmit nonstop as they do in a broadcast transmitter that transmits 24 hours a day, 7 days a week, thus the phrase intermittent is in the title. The Broadcast service would be rated CCS or “Continuous Commercial Service”. ICAS assumes that no single transmission will ever be longer than 5 minutes and that every transmission will be followed by a period of no transmission of an equal or longer length than the transmission was. For instance, it assumes that we will transmit for 3 minutes then not transmit for at least 3 minutes. However long we transmit, we will immediately rest for the same or greater length, and we will never transmit for more than 5 minutes at any time. For many amateurs, these assumptions will be accurate. However, for many of us they will not be. Many hams transmit much longer than 5 minutes at a time. Many, especially contesters, certainly do not wait long at all between their transmissions. Therefore, many amateurs will find that the ICAS definition doesn't really apply to their station even though they are in the Amateur Service. This has resulted in some folks jokingly saying that the ICAS rating stands for “I Can Assume Something”. To show you just how inadequate the ICAS rating can be for some hams, consider that my antenna has a 2 KW ICAS rating, yet it started to overheat and lose performance in a contest when I was only using 500 watts! This happened because my duty cycle was almost 100% for those five hours. I only paused long enough to hear the other station's call sign, and then immediately transmitted to respond, and then on to the next. Luckily, the antenna was not permanently damaged because I switched to another antenna for an hour to let it cool off, and then it worked fine for hours more. An old rule of thumb was to consider that a CCS rating would be 25% of an ICAS rating. So if you had a rating of 100W ICAS you could say that same part had a rating of 25W CCS. Also, different modes have different duty cycles. SSB will be much less stressing than CW or a carrier mode of operation. Therefore, things can have a higher power rating for SSB than they do for true AM, or CW or digital

modes. This is one of the great advantages to the efficiency of SSB and one reason it became so popular. All this is to say, that before the question “How much power can it take?” is answered, other variables must be known such as mode type and duty cycle.

### Antenna Performance

Being able to effectively couple RF into an antenna system is only part of what makes the antenna system effective. A dummy load accepts RF readily. To be a good antenna, the antenna must also radiate well. How the End Fed Half Wave or End Fed Multiband Antenna performs will depend greatly on how it is installed. This antenna is versatile in that it may be installed in many different configurations. Obviously, different performance will be had with different installation configurations. It is important to remember that when people make claims such as “this antenna can be used in a horizontal configuration close to the ground” that they are talking about the antenna’s ability to couple RF into itself from the feedline, not the antenna’s ability to radiate well. Any low horizontally polarized antenna will have a high angle of radiation regardless of if it is a monoband or multiband antenna and regardless of how it is fed.

I chose to install mine as an inverted L. The reasons I choose this installation technique are several. First, one of the greatest benefits of an end-fed antenna is that the feed point can be closer to the radio, reducing the amount of feedline required. Unlike a dipole, this antenna does not require coax to hang high in the air, which can be an ugly logistical challenge. By installing the antenna as an Inverted L the feed point can be near the ground and easy to work with. I mount mine about 4 feet above the ground on a wooden fence post. This makes it easy to ground. If the feed point is high in the air, grounding becomes a challenge, not so when it is only 4 feet above the earth. When feeding it near the ground vertical polarization is ideal because if the antenna is horizontally polarized at less than a half wavelength above ground the radiation pattern will be poor and ground losses high (as is the case for any horizontally polarized antenna). I am not interested in Near Vertical Incidence Sky wave (NVIS) propagation. However, I do like to have some of my signal horizontally polarized because when I work groundwave nets on 80 meters for the NTS and for our local QCWA and club lets, many of the other stations I’m working are using horizontally polarized antennas. By going vertical for 80 feet, then folding the wire over an oak tree branch and going horizontal for the remaining 54 feet I accomplish the goal of having some of my signal radiate from a horizontal antenna, and that horizontal section is 80 feet above ground which is an adequate height to give good performance for a horizontal antenna. An end fed multi band antenna like this fed as an inverted L does not have the same radiation pattern as the old fashioned  $\frac{1}{4}$  wave inverted L that we are all familiar with. A typical, old fashioned  $\frac{1}{4}$  wave inverted L is a  $\frac{1}{4}$  wave antenna that is partly vertical and partly horizontal, fed against ground (and ideally ground radials). It has (mostly) vertical polarization with the horizontal portion mostly serving as a capacity hat, slightly reducing the length of wire needed. It is usually used when there is not enough vertical support to bring the entire  $\frac{1}{4}$  wave straight up. This antenna, an 80 meter end fed half wave as an inverted L is actually a  $\frac{1}{4}$  wave traditional inverted L on 160 meters. I use it with great effect that way by simply disconnecting the coax from the matching transformer and connecting

the center pin of the coax directly to the radiator wire by using an SO-239 connector soldered to some jumper wire with an alligator clip on the end of it. I then use a large alligator clip to connect the shield side of the feedline's PL-259 connector to my ground cable. However, when the antenna is used with the matching transformer on bands 80 and higher, it performs differently. Many different lobes form along the antenna, some will be vertically polarized and some will be horizontally polarized. The number and shape of the lobes will be different on each band. I have found that I get good overall omnidirectional performance from this antenna and have slightly stronger signals and more contacts to the north east and south west. The favoritism shown towards those directions, I believe comes from the fact that the horizontal section of my antenna is broadside to those directions. Most of my activity consists of contesting and rag chewing, with a few nets thrown in. This antenna works very well for all of those as it works well on 160 to 10 meters, is automatically band switching on bands 80 and higher.

At the base of my antenna I drove an 8 foot copper clad steel ground rod. I then connected the ground lug on my matching transformer to that ground rod using #4 solid copper wire. I then buried 100 feet of solid #4 copper wire connecting that ground rod to my house's ground rod where the rest of my station is grounded. Thus comply with electric code to bond all grounds, and giving me one buried radial which is helpful when I use the antenna as a traditional inverted L on 160 meters. In the same trench as the ground wire, I buried my coax. I am feeding it with DX engineering's version of LMR 400. After being buried for 100 feet the coax comes out of the ground next to my house where it enters a waterproof panel box on the side of my house. There it connects to a polyphaser lightning arrester which is grounded to the house ground rod system at that point. The coax then goes to an A/B switch. In the A position a section of coax leads to my back porch where I will occasionally sit with a radio and make contacts in nice weather. The B position connects to another 50 feet of coax which goes up stairs into my radio room where it connects to another switch that allows me to connect any of several different transceivers into it.

The End Fed Half Wave Multi Band Antenna can be installed in several different configurations, and while different installation methods may have only minimal effect on the ability to couple RF into the antenna, they will have significant impact on the antenna's radiation pattern. Additionally, it is always important to remember that this antenna will have a different radiation pattern on each band because it is a different wavelength long on each band. For instance, it is a half wave antenna on 80 meters, but is a full wave antenna on 40 meters and is two full waves on 20 meters, etc. That means, for instance, not only will the antenna have a different number of radiation lobes depending on how many wave lengths (or portions of wavelengths) long it is on any given band, but also if the antenna was mounted horizontally at 66 feet, it would be  $\frac{1}{4}$  wave length high when it is used on 80, but would  $\frac{1}{2}$  wave length high when used on 40, and a full wavelength high when used on 20, etc. This reality impacts the radiation pattern on the different bands. This is part of the compromise found when using one antenna to work on multiple bands. It may work better on some bands than others, and it may work well on all bands, but it will not work identically on all bands.

One way to test an antenna's radiation performance is to make many contacts and do an A/B test

comparing the antenna under review with a different antenna to see how they compare. Thanks to the Reverse Beacon Network (RBN) this is very easy to do. I simply called CQ via CW using antenna A, looked at how RBN recorded my signal strength, then quickly switched to antenna B and did the same thing. I put it on an A/B coax switch and compared it against an inverted Vee at 70 feet. It compared very favorably. Sometimes the End Fed was better and sometimes the Inverted Vee was better. There was no clear winner. The Inverted Vee often gave me higher signal strengths but a less desirable signal to noise ratio than the End Fed gave. Other times one was clearly better. Next, I decided to call CQ on 40 CW on both antennas and see what numbers the Reverse Beacon Network system gave me. Here are the results of that initial test. As you can see, they matched my observation that there was no clear winner.

| RBN Station | EFHW | INV VEE |
|-------------|------|---------|
| W1NT/6      | 14   | 37      |
| WE9V        | 24   | 20      |
| K9TM-4      | 8    | 0       |
| KQ8M        | 19   | 20      |
| K2DB        | 13   | 0       |

Saying that the End Fed antenna is at least equal to the inverted Vee in terms of radiation was great news because Inverted Vee is a very solid performer. The End Fed antenna has advantages beyond its actual performance too, namely; ease of use. The Inverted Vee fed with ladder line requires me to adjust the tuner and sometimes the amplifier load control whenever I change frequencies. While this is not a hardship for most operations, it does slow me down in contests and cannot be operated via remote control. I estimate that it costs me 1 to 2 QSOs every time I need to change bands based on my average QSO rate. The End Fed antenna can be much easier to install than a dipole (even a dipole hung as an Inverted Vee). Additionally, the ability to use coax as a feedline on the multi band antenna allows the installer to run the feedline in ways that ladder line cannot be installed (such as being buried or next to other wires) and it allows the use of a poly-phaser for lightning protection with great ease.

I have found that this antenna accepts RF well on many different bands and radiates well on all of them. It can be fed with coax directly from my transceiver. It is, therefore, the best single wire, multi band antenna I have found so far

